

Blood Group Distribution in Basques

H. M. VAN DER HEIDE, WILLY MAGNÉE, J. J. VAN LOGHEM¹

Central Laboratory of the Netherlands Red Cross Blood Transfusion Service, Amsterdam

AND

L. SOUCHARD

Regional Blood Transfusion Service of the Basses Pyrénées, Biarritz, France

THE Basques located in the northern part of Spain and south-western part of France near the Pyrénées form a population anthropologically distinct from the surrounding populations (Barge, 1938). Moreover, investigations of the Basques have revealed unusual blood group frequencies.

Boyd *et al.* (1937) made tests for the ABO groups in 229 Basques living at San Sebastian, Spain. They found a high percentage of group O and a low percentage of group B. Their sample was shown statistically to be heterogeneous, but subsequent more extensive studies have confirmed the finding that group O has a higher frequency among Basques and group B a lower frequency, as compared with western Europeans in general.

Table 1, taken from Etcheverry (1949), shows the frequencies of the ABO groups found by several investigators in Basques living in Europe and in South America. It appears that the frequency of group O is always above 50 per cent and that the percentage of group B is generally very low. Cajiao, it should be noted, found a relatively larger proportion of group B, but this author included some *families* having the B factor.

Chalmers *et al.* (1949) made tests for the ABO groups and A-subgroups (A_1 and A_2) in a series of 383 Basques, mostly of Spanish origin, and recorded the following frequencies:

Subgroup:	O	A_1	A_2	B	A_1B	A_2B
Frequency(%):	51.17	37.34	6.27	4.18	1.04	—

The M-N distribution in Basques is hardly different from that of other western Europeans, but the Rh frequencies have again proven to be unusual. Among 250 people of Basque origin living in Argentina, Etcheverry (1945, 1947) found 35.6 per cent Rh-negative. Moulinier (1949) found 28.7 Rh-negatives among 233 Basques at Navarre, Spain; 42.5 per cent Rh — among 250 Basques at Soule, France; and 35.25 per cent Rh — among 89 Basques in the Bearnais region. Guasch (1950) reported 24.34 per cent Rh-negatives among 649 Spanish Basques. Eyquem (1950) found an even higher frequency, 42 per cent, among 400 Basques living in Navarre; however, in calculating the frequencies, family relationship within the group was not taken into consideration.

Thus, in Europe, about 20–40 per cent of the Basque population has proven to be Rh-negative, a proportion distinctly higher than that found elsewhere in western Europe (Fisher & Race, 1946; Bessis & Gorius, 1947; van Loghem & Berkhout, 1948).

These remarkable findings on the Rh groups of Basques made Mourant (1947) and Etcheverry (1949) suggest the hypothesis that the Basques are

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very pure descendants of a population which originally lived in western Europe and was predominantly Rh-negative. Invasions of Rh-positive peoples from eastern Europe and Asia are supposed to have mixed with this original western European population and thus jointly contributed to the present distribution in the Rh system. Perhaps because of ecological barriers the Basques were protected longest from mixing with the bearers of Rh-positive blood.

TABLE 1. REPORTED FREQUENCIES OF ABO GROUPS IN BASQUES (PER CENT)

INVESTIGATORS	TOTAL NUMBER TESTED	O	A	B	AB
<i>Locality</i>					
Etcheverry (1949)	250	56.0	40.8	2.8	0.4
Boyd, <i>et al.</i> (1937)	229	56.8	39.7	1.3	2.2
Dujarric de la Rivière, Kossovitch	?	57.2	41.7	1.1	—
Martial	?	53.5	42.8	2.8	0.9
Jauréguiberry	?	62.0	36.0	2.0	—
<i>Haute Soule</i>					
Darmendrail	?	66.0	32.0	2.0	—
<i>Hasparren</i>					
Ganzarain Cajiao	200	52.0	39.5	6.5	2.0
<i>Chili</i>					

TABLE 2. ABO GROUPS AND SUBGROUPS IN BASQUES (PRESENT STUDY)

	O	A	A ₁	A ₂	B	AB	A ₁ B	A ₂ B
Number.....	94	28	39	11	6	1	—	2
Per cent.....	51.9	43.1			3.3	1.7		

Gene frequencies: $p = 0.257 \pm 0.002$; $q = 0.025 \pm 0.008$; $r = 0.720 \pm 0.023$

$D = 1 - p - q - r = 0.002 \pm 0.005$

PRESENT INVESTIGATION

One of the present authors (L. S.) was recently granted the opportunity of collecting bloods from a group of 181 Basques living in Biarritz and the surrounding area. The samples were taken by venepuncture and dispatched by air to Amsterdam. The longest time lapse between the drawing of the blood and the examination was 48 hours. The samples all arrived in good condition, and difficulties due to hemolysis or bacterial contamination were not encountered.

Judging from the family names of some subjects, a number were of Spanish Basque descent; the majority, however, were French Basques. Family relationship within the total group examined cannot be wholly excluded, but we avoided this as much as possible.

ABO system. Table 2 shows the results of our tests for the ABO groups.

Unfortunately, the subgroups of A were tested in only 50 out of 78 cases, and subgroups of AB in only two out of 3 bloods. Consequently the frequencies of genes A_1 and A_2 (p_1 and p_2) have not been calculated.

Chalmers *et al.* (1949) calculated the following gene frequencies for their sample of 383 Basques: $p_1 = 0.215$, $p_2 = 0.041$, $q = 0.027$, $r = 0.717$. Com-

TABLE 3. MN TYPES IN BASQUES (PRESENT STUDY)

	M	MN	N
Number.....	68	76	36
Per cent.....	38.1	42.0	19.9

Gene frequencies: $m = 0.591 \pm 0.025$; $n = 0.409 \pm 0.025$
 $\chi^2 = 3.123$, D.F. = 1

TABLE 4. RH PHENOTYPE AND GENE FREQUENCIES (PRESENT STUDY)

PHENOTYPE* (MOST PROBABLE GENOTYPE)	NUMBER	PER CENT	GENE FREQUENCIES*
CDe/CDe R_1R_1	32	17.7	
CDe/cde R_1r	60	33.1	
CDe/cDE R_1R_2	20	11.0	
cDE/cde R_2r	16	8.8	cde (r) = 0.493 ± 0.025
cde/cde rr	44	24.3	Cde (r') = 0.012 ± 0.005
Cde/Cde $r'r'$	1	0.6	CDe (R_1) = 0.416 ± 0.025
Cde/cde $r'r$	1	0.6	cdE (r'') = 0.006 ± 0.004
cdE/cdE $r''r''$	1	0.6	cDe (R_2) = 0.006 ± 0.004
cDe/cde R_0r	1	0.6	CdE (r_y) = 0.006 ± 0.004
C ^w De/cDE $R_1^wR_2$	1	0.6	C ^w De (R_1^w) = 0.006 ± 0.004
CdE/cde r_yr	1	0.6	cDE (R_2) = 0.055 ± 0.011
CdE/CDe r_yR_1	1	0.6	
CdE/Cde r_yr'	1	0.6	
CD ^u e/cde R_1^ur	1	0.6	
Totals.....	181	100.3	

* All bloods were tested with anti-C, D, E, c, C^w and D^u. Since anti-e serum was not available for these tests, the gene frequency for cDE has been computed as the difference: $1 - (\overline{CDe} + \overline{cDe} + \dots)$.

The gene C^wDe was found only in combination with cDE. Therefore no figure is given for the frequency of gene C^wDe; in fact, the figure given for the frequency of gene cDE might be regarded as representing $\overline{cDE} + \overline{C^wDe}$.

paring the sum $p_1 + p_2 = 0.256$ with our estimate $p = 0.257$, it is apparent that our findings are very similar.

MN system. Table 3 gives our results for the MN blood types. A somewhat smaller frequency of the M gene was found by Chalmers *et al.*: $m = 0.538 \pm 0.017$, but this value does not differ significantly from the value $m = 0.591$ in our sample.

Rh system. Table 4 summarizes our findings on the Rh blood types in the

same series of 181 Basques. All of these bloods were tested with anti-C (rh'), anti-D (Rh₀), anti-E (rh''), anti-c (hr'), anti-C^w, and anti-D^u.

Fairly close agreement is again found between our results and those of Chalmers *et al.*, who recorded the following estimated gene frequencies:

$$\begin{aligned}cde &= 0.5316 \pm 0.017 \\Cde &= 0.0147 \pm 0.004 \\CDe &= 0.3756 \pm 0.017 \\cdE &= 0.0025 \pm 0.002 \\cDe &= 0.0050 \pm 0.002 \\cDE &= 0.0707 \pm 0.009\end{aligned}$$

These workers found 27.4 per cent Rh-negative (cde/cde) bloods in the sample of 383 Basques, compared with our finding of 24.3 per cent.

TABLE 5. BLOOD GROUP GENE FREQUENCIES AND TESTS OF HOMOGENEITY. BUNSCHOTEN AND SPAKENBURG, NETHERLANDS

ABO SYSTEM	MN SYSTEM	RH SYSTEM
$p_1 = 0.172 \pm 0.015$ $p_2 = 0.104 \pm 0.012$ $p = 0.269 \pm 0.018$ $q = 0.056 \pm 0.009$ $r = 0.675 \pm 0.019$ $D = 0 \pm 0.020$	$m = 0.518 \pm 0.020$ $n = 0.482 \pm 0.020$ $\chi^2 = 0.848$ D.F. = 1	$cde(r) = 0.501 \pm 0.020$ $Cde(r') = 0.014 \pm 0.005$ $CDe(R_1) = 0.375 \pm 0.020$ $cdE(r'') = 0.004 \pm 0.003$ $cDE(R_2) = 0.106 \pm 0.012$ $\chi^2 > 30$ D.F. = 4*

* The unsatisfactory fit of the data to the genetic theory is largely due to a discrepancy in the proportion of CDe/cDE (R₁R₂) samples.

Our own results are probably somewhat atypical because of the inclusion in the series of a single family containing three genotypes involving the rare gene-complex Cde (r'). This family has been described elsewhere (Grove-Rasmussen *et al.*, 1951).

Vaccaro *et al.* (quoted by Chalmers *et al.*) found 33 per cent Rh-negative individuals among Basque immigrants in Chile. It has been assumed that these unusually high figures for the Rh-negative type found by Etcheverry and other South Americans may be due in part to the fact that too weak anti-D sera were used. We cannot support these observations since in our series of 181 tests we encountered only one individual carrying the gene D^u.

Comparing the results of our own study and that of Chalmers *et al.* with data on western Europeans in general, it appears that Basques show a significantly higher frequency of the gene cde (r) and a significantly lower frequency of the gene cDE (R₂).

But table 5 will show that the Basques do not occupy an entirely unique place in western Europe so far as the frequency of cde is concerned. This table summarizes a preliminary blood group investigation on a Dutch population

group which is considered to be autochthonous and to have been settled near the former Zuiderzee for ages. The tests were carried out by one of us (v. d. H.) on a group of 279 residents of Bunschoten and Spakenburg, in the province of Utrecht.

The Rh phenotype cDe (R_0) and the gene C^w were not encountered in this group. Whereas in Holland generally the frequency of cde (r) is about 0.375, the people of Bunschoten and Spakenburg reveal a significantly higher frequency of this gene-complex (0.501 ± 0.020), about equal to that found in French and Spanish Basques. Although in this and other Rh gene frequencies, the Basques and the natives of Bunschoten do not differ significantly, this of course does not mean that the two groups are necessarily comparable anthropologically.

SUMMARY

Data are presented concerning the ABO, MN and Rh gene distributions in a group of 181 Basques living in the vicinity of Biarritz in south-western France. The findings are compared with a number of other investigations on Basque populations. The gene frequencies found in the sample of 181 are the following:

	Rh: cde = 0.493 ± 0.025
ABO: $p = 0.257 \pm 0.022$	Cde = 0.012 ± 0.005
$q = 0.025 \pm 0.008$	CDe = 0.416 ± 0.025
$r = 0.720 \pm 0.023$	cdE = 0.006 ± 0.004
	cDe = 0.006 ± 0.004
MN: $m = 0.591 \pm 0.025$	CdE = 0.006 ± 0.004
$n = 0.409 \pm 0.025$	CD ^w e = 0.006 ± 0.004
	cDE = 0.055 ± 0.011

That the Basques are not unique among western Europeans in their high frequency of Rh-negatives is revealed in a preliminary study of 279 inhabitants of the Dutch villages of Spakenburg and Bunschoten in the province of Utrecht. The frequency of the Rh-negative gene is here cde = 0.501 ± 0.020 .

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